United States Department of Agriculture

Forest Service

North Central Forest Experiment Station

Research Paper **NC-242**

# Weight and Volume Equations and Tables for Red Maple in the Lake States

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Crow, T. R.; Erdmann, G. G.
Weight and volume equations and tables for red maple in the Lake States. Res. Pap. NC-242. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1983. 14 p.

Weight and volume information based on regional sampling are provided for red maple in the Lake States. Both green weight and dry weight values are presented for biomass. Volume equations predict total stem volume, volume to 8-inch top, and volume to 4-inch top, inside and outside bark.

KEY WORDS: *Acer rubrum,* biomass, total tree weight, component weight, stand weight, stem volume.

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**Manuscript approved for publication February 14, 1983**
**December, 1983**

# WEIGHT AND VOLUME EQUATIONS AND TABLES FOR RED MAPLE IN THE LAKE STATES

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Red maple (*Acer rubrum* L.) is a common component of second-growth forests in the Lake States. In Michigan's Upper Peninsula, it is second only to sugar maple (*Acer saccharum* L.) in terms of standing volume, and it is an important resource on more than 1 million acres of commercial forest in the region.

Changing patterns of utilization have resulted in the need for mensurational information expressed as weight or biomass (Young 1974). In addition, more traditional mensurational units such as volume need to be derived for various standards of utilization. Although regression equations are available for predicting biomass of many hardwood species including red maple, most of these predictive equations are based on limited sample numbers and sample sites. Nothing in the theory of regression analysis suggests that these equations can be applied elsewhere—they are valid for regional application only if they are based on regional sampling.

As part of a program in growth and yield research in northern hardwoods, volume and biomass information are presented here for red maple. The study objective was to predict weight and volume for red maple stands and individual trees across a range of stand ages and site qualities. The scope of the research included:

(1) developing regression estimators for whole-tree and component weights and volumes for red maple and comparing these estimators among sites;

(2) preparing weight tables from regression equations for the total tree and its components by d.b.h. and total height classes; and

(3) predicting stand weights from measurements such as basal area and mean stand height.

## METHODS

To provide a regional framework for predicting red maple weight and volume, sample sites were selected in Michigan and Wisconsin that represented the population of even-aged hardwood forests in the Lake States. Six sample stands, each dominated by red maple, were selected as closely as possible to the following age and site index (at age 50) specifications:

| Stand age (years) | Site index (SI) |
|---|---|
| 40 | ≤45 |
| 70 | ≤45 |
| 40 | 50–55 |
| 70 | 50–55 |
| 40 | ≥60 |
| 70 | ≥60 |

Sugar maple was a common associate of red maple on all sites. In the 70-year-old stands, beech (*Fagus grandifolia* Ehrh.), yellow birch (*Betula alleghaniensis* Britton), basswood (*Tilia americana* L.), and hemlock (*Tsuga canadensis* (L.) Carr) were also common components. Other species frequent to the 40-year-old stands include black cherry (*Prunus serotina* Ehrh.), pin cherry (*Prunus pensylvanica* L.), paper birch (*Betula papyrifera* Marsh.), and aspen (*Populus tremuloides* Michx).

Within a sample stand, all red maple were numbered and d.b.h. measured and recorded. The numbered trees were partitioned into five d.b.h. classes (minimum diameter = 10 cm d.b.h.), with each class having an equal number of stems. Within a class, five trees were randomly selected for destructive sampling, thus providing 25 trees per site for a total of 150 samples in the study (table 1.)

The procedures used to sample biomass of individual trees have been presented elsewhere (Crow 1983). Total tree in our paper refers to aboveground weight and is the sum of live canopy, dead branches, bole, and stump. Total canopy includes live branches and leaves but excludes dead branches.

Weight/tree dimension relations were expressed in the linear form of the allometric equation: $\ln Y = a + b(\ln X) + \ln\epsilon$. D.b.h. and $D^2H$ (D.b.h. squared times total height) were the independent variables; green weight and dry weight were the dependent variables. Both English and metric units are provided. Analysis of covariance was used to determine if significant differences existed among sets of allometric equations representing the six sites (Snedecor and Cochran 1967).

Standardized curves were also developed for each stand age (40 and 70 years) using dummy variables in a multiple regression to control spacing (Jacobs and Cunia 1980, Draper and Smith 1981).

By fitting

$$\ln Y = \ln B_0 + B_1 \ln X + \alpha_1 \ln Z_1 + \alpha_2 \ln Z_2 + \ln\epsilon,$$

where $(\ln Z_1, \ln Z_2) = (1,0)$ for SI $\leq 45$

$(\ln Z_1, \ln Z_2) = (0,1)$ for SI 50-55

$(\ln Z_1, \ln Z_2) = (0,0)$ for SI $\geq 60$

and substituting for the three sets of values for $\ln Z_1$ and $\ln Z_2$, three curves with the same slope but different intercepts are obtained. Uniform spacing among intercepts is obtained by regressing the intercept with site index and using the estimated intercepts in the standardized curves.

A set of asymptotic regressions is also calculated using the model, $Y = \alpha + B_P{}^Z$,

where: Y is the dependent variable that approaches an asymptotic limit as Z approaches infinity;
$\alpha$ represents the asymptotic values of Y;
B represents the total change in Y as Z passes from 0 to +;
P represents the factor by which the rate of change in Y reduces as Y approaches its asymptote; and
Z is the independent variable.

Schwandt's (1979) procedures for estimating the vector parameters for asymptotic regression were used to simultaneously fit the curves.

For volume predictors, two additional sampling locations were added to the six sites previously mentioned. The additional sites, both located in Michigan, included a SI = 61, 50-year-old stand and a SI = 63, 53-year-old stand. Volumes were predicted using the linear form of the allometric equation and a simple linear model with D.B.H., D.B.H.$^2$, and $D^2H$ as the independent variables.

# APPLICATION OF EQUATIONS

Differences in stand age and site index did not result in significant differences in biomass or volume equations. Regardless of the independent or dependent variable tested, no statistical differences were found at the $P \leq 0.05$ level in regression slopes or intercepts among the sample sites (Crow 1983).

These results indicate that a general biomass predictor is valid for red maple within the range of data tested (table 1). Because the sample sites represent the range of site and stand conditions for red maple in the Lake States, the general predictors are recommended for regional inventories within the Lake States (table 2). Application of a general predictor to a specific site or application outside the sample region, however, could result in substantial bias.

The error associated with weight estimates did differ substantially among components (table 2). Total tree weight or bole weight can be estimated with greater confidence than canopy weight.

Although differences among the $D^2H$ predictors were statistically nonsignificant using the test criterion $P \leq 0.05$, plots of individual curves often indicated consistent trends among equations that were correlated to site index and stand age (fig. 1). This consistency suggests that for specific sites, greater accuracy can be obtained by including site quality and stand age in the predictive model. Under the assumption that a larger sample size would result in uniform spacing among curves in figure 1, the original equations for total weight/$D^2H$ have been "standardized" using dummy variables to control spacing. When applying these predictors, simply select a table based on the weight units (English or metric, green weight or dry weight) and select the predictor that most closely represents your sample population in terms of stand age and site quality. Total tree weights are given in the following tables:

Table 3—green weight-metric, stand age~40 years,
Table 4—green weight-metric, stand age~70 years,
Table 5—dry weight-metric, stand age~40 years,

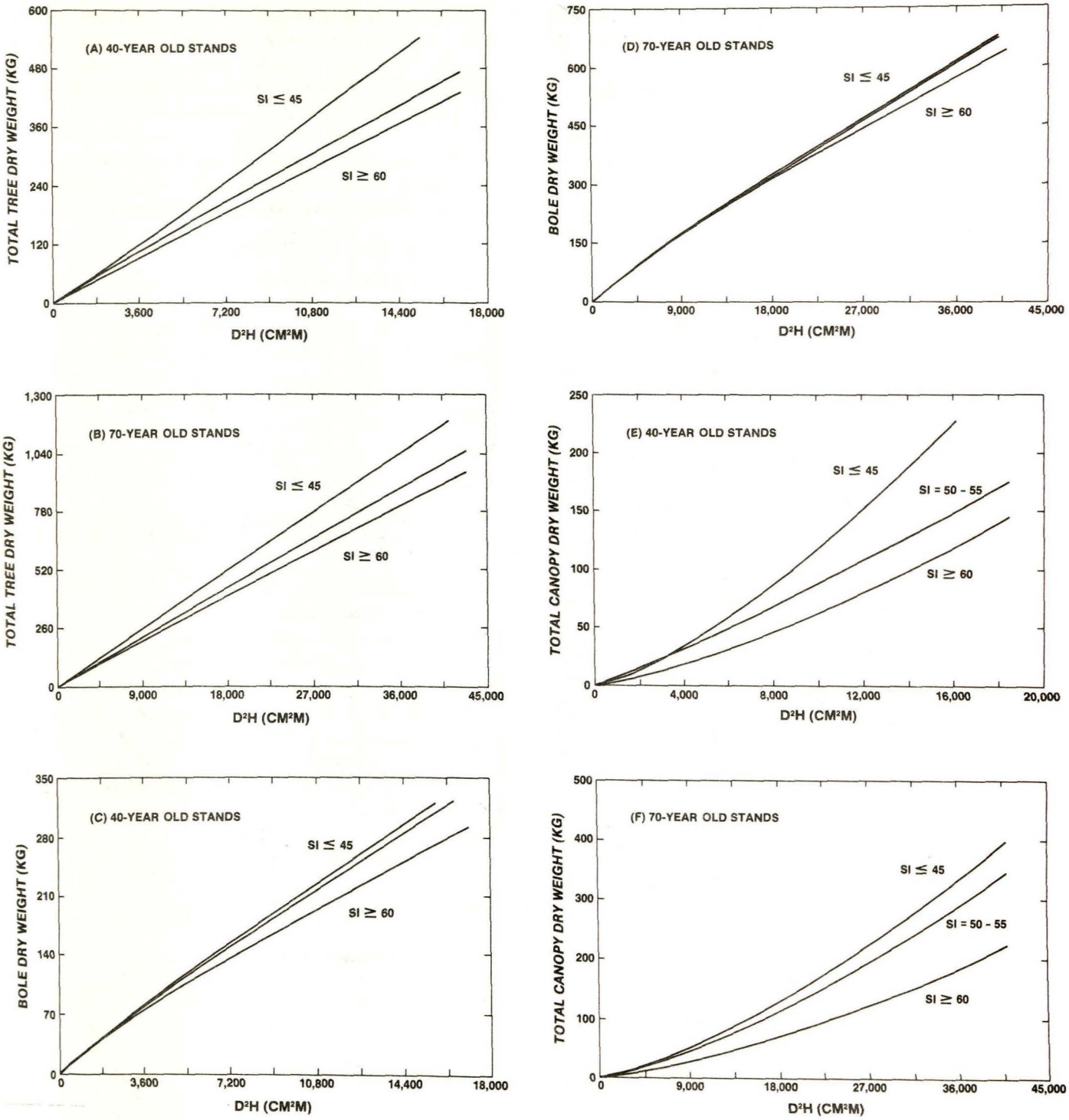


Figure 1.—*Comparison of allometric relation between $D^2H$ and (A) total tree dry weight for 40-year-old stands; (B) total tree dry weight for 70-year-old stands; (C) bole dry weight for 40-year-old stands; (D) bole dry weight for 70-year-old stands; (E) canopy dry weight for 40-year-old stands; and (F) canopy dry weight for 70-year-old stands.*

Table 6—dry weight-metric, stand age~70 years,
Table 7—green weight—English, stand age~40 years,
Table 8—green weight—English, stand age~70 years,
Table 9—dry weight—English, stand age~40 years,
Table 10—dry weight—English, stand age~70 years.

With d.b.h.-dry weight as the variables, differences among sites were so small (fig. 2) that the individual curves provided little additional resolution and the common regression in table 2 was used to generate the values in table 11.

The term forest residuals applies to recoverable and usable materials left in the forest following harvest. Equations presented in table 12 can be used to

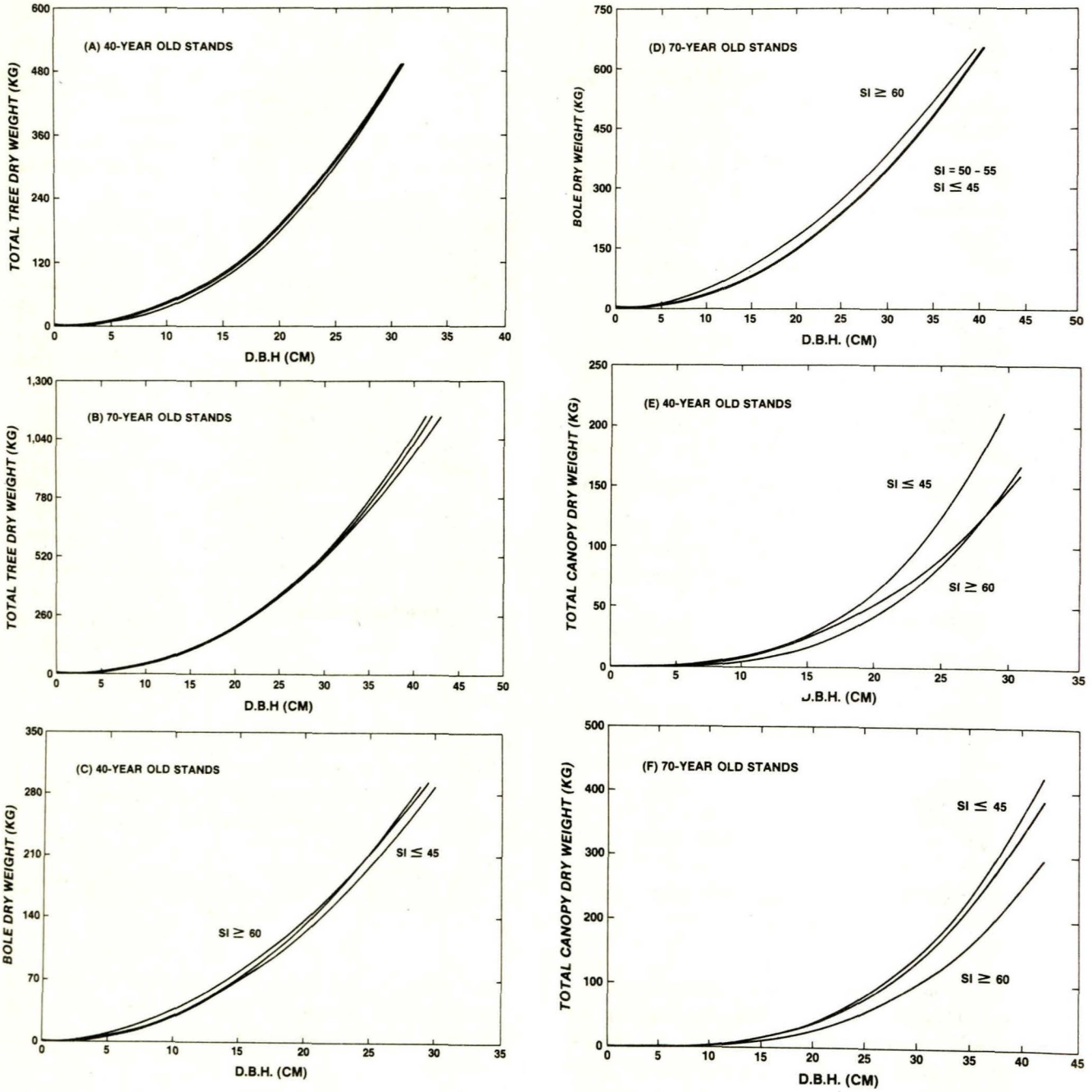


Figure 2.—*Allometric relations between d.b.h. and (A) total tree dry weight for 40-year-old stands; (B) total tree dry weight for 70-year-old stands; (C) bole dry weight for 40-year-old stands; (D) bole dry weight for 70-year-old stands; (E) total canopy for 40-year-old stands; and (F) total canopy for 70-year-old stands.*

predict residual green weight above a 4-inch top, including canopy weight.

The percentage of total weight represented by residual material differs greatly with tree size (fig. 3). The percentage of residual weight declines rapidly as tree size increases and it becomes constant at 22-24 percent in the 18 to 26 cm d.b.h. range. The increase observed for the largest size classes reflects the two-aged nature of most second-growth hardwood stands. The second-growth stands originated in most part from commercial clearcuts in which a number of smaller stems or culls were not cut. As dominants in the new stand, these residual trees often developed large crowns and thus have large residual weights. On the average, approximately a 30 percent increase in harvest yield would result for red maple if residual weight is harvested along with merchantable weight (above 1-foot stump to a 4-inch top) in a full-tree harvest.

In addition to estimates of individual tree weight, weight yields can be estimated from stand measurements. Stand weights were estimated as a function of stand basal area (B) and average total stand height (H), and were expressed as a composite index (BH) in a linear regression (fig. 4). Stand estimates were derived by summing individual tree estimates on 32-1,000 $m^2$ plots located on the six sample sites. Individual tree regressions developed in our study were applied to red maple. Published regressions were utilized for the other species (Zavitkovski 1971, Crow 1977). From estimates of total stand weight (dry

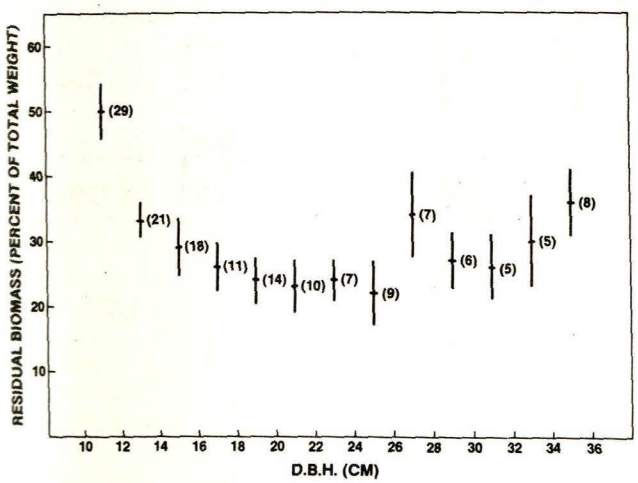


Figure 3.—*Residual biomass as a percentage of total aboveground biomass presented as mean with ± 1SD by diameter class (e.g. ≥ 10 < 12 cm d.b.h....). Values in parentheses represent number of samples in diameter class. Residual biomass is defined as tops above 4-inch diameter inside bark, branches, and foliage.*

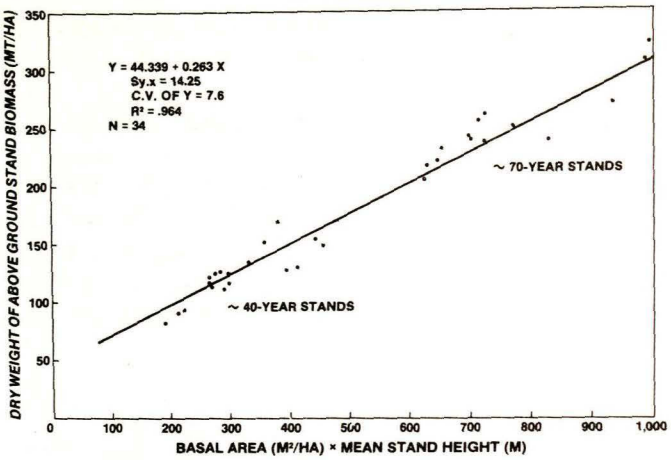


Figure 4.—*Stand dry weight expressed as a linear function of mean stand height and stand basal area for forests dominated by red maple.*

weight of stump, bole, and canopy), estimates of merchantable stem weight to various top diameters (inside bark) can be obtained by applying the ratios of merchantable weight:total weight presented in figure 5. These asymptotic equations estimate the proportions of merchantable weight as a function of average stand diameter and merchantable top diameter.

For example, a stand with 35 $m^2$/ha (152 $ft^2$/a) of basal area and a mean height (based on dominants and codominants) of 21 m (69 ft) has an estimated aboveground stand weight equal to 238 mt/ha (aboveground stand dry weight = 44.339 + 0.263 (735) from figure 4). Given an average stand diameter of 8.5 inches and a 4-inch utilization limit, the ratio of merchantable weight to total dry weight obtained in figure 5 is 0.66. Thus, 0.66 x 238 = 157 mt/ha (70 short tons/a) represents the merchantable dry weight of the stand.

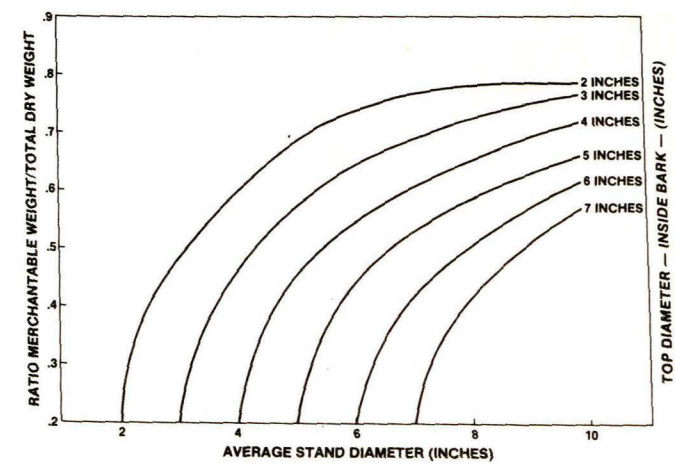


Figure 5.—*The ratio of merchantable weight to total aboveground dry weight expressed as a function of average stand d.b.h. and top diameter inside bark.*

Regression equations for estimating volume did not differ significantly among the sample sites, and thus a single predictor was developed for all sites. Stem volume inside bark and outside bark as well as volume inside bark to 8-inch and 4-inch tops can be estimated using the equations in table 13. The equation for volume to an 8-inch top is based on a variable length stem. Volume estimates to a 4-inch top are based on full 100-inch sticks, with a minimum of 4-inches inside bark for the top 100-inch stick.

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Table 1.—*Characteristics of sample stands and sample trees*

| Stand location | Stand age | Site index[1] | Red maple | Other species | Sample trees—red maple | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | D.b.h. | | Total height | |
| | | | | | Mean | Range | Mean | Range |
| | *Years* | | *---Stems/ha---* | | *---------cm---------* | | *----------m----------* | |
| Wetmore, MI | 40 | ≤ 45 | 685 | 537 | 13.7 | 10.0-26.6 | 13.85 | 12.63-16.60 |
| Sugar Bush, MI | 40 | 50-55 | 564 | 412 | 13.7 | 10.0-24.6 | 13.83 | 12.23-15.90 |
| Eagle River, WI | 40 | ≥ 60 | 483 | 407 | 17.1 | 10.0-33.2 | 17.70 | 13.65-20.74 |
| Rock River, MI | 70 | ≤ 45 | 607 | 41 | 24.0 | 10.4-46.1 | 19.42 | 12.14-22.65 |
| Argonne, WI | 70 | 50-55 | 643 | 167 | 20.5 | 10.5-36.2 | 19.74 | 15.10-23.10 |
| Silver Falls, MI | 70 | ≥ 60 | 478 | 305 | 28.5 | 14.0-52.2 | 24.92 | 18.08-26.84 |

[1]Site Index–feet at age 50.

Table 2.—*General biomass predictors for red maple in the Lake States (regression model: $lnY = a + blnX$; ln = natural logarithms; N = 150; where Y = weight, X = d.b.h. or $D^2H$)*

| Dependent variable | Independent variable | Intercept (a) | Slope (b) | $r^2$ | $S_{y \cdot x}$[1] | Correction factor[2] |
|---|---|---|---|---|---|---|
| | | **Dry Weight-kilograms** | | | | |
| Total tree | D.b.h.(cm) | -1.721 | 2.334 | 0.98 | 0.116 | 1.007 |
| Bole wood | D.b.h. | -1.833 | 2.234 | .97 | .152 | 1.012 |
| Bole bark | D.b.h. | -3.207 | 1.985 | .95 | .186 | 1.017 |
| Total bole | D.b.h. | -1.637 | 2.207 | .97 | .150 | 1.011 |
| Leaves | D.b.h. | -3.288 | 1.540 | .54 | .569 | 1.173 |
| Branches | D.b.h. | -4.899 | 2.831 | .85 | .479 | 1.120 |
| Total canopy | D.b.h. | -4.385 | 2.701 | .84 | .471 | 1.116 |
| Total tree | $D^2H(cm^2m)$ | -3.008 | .928 | .98 | .139 | 1.009 |
| Bole wood | $D^2H$ | -3.158 | .898 | .99 | .104 | 1.005 |
| Bole bark | $D^2H$ | -4.404 | .801 | .97 | .142 | 1.010 |
| Total bole | $D^2H$ | -2.943 | .888 | .99 | .099 | 1.005 |
| Leaves | $D^2H$ | -3.648 | .556 | .44 | .627 | 1.213 |
| Branches | $D^2H$ | -6.128 | 1.087 | .79 | .568 | 1.173 |
| Total canopy | $D^2H$ | -5.539 | 1.035 | .77 | .559 | 1.166 |
| | | **Dry Weight-pounds** | | | | |
| Total tree | D.b.h.(inches) | 1.245 | 2.334 | .98 | .116 | 1.007 |
| Bole wood | D.b.h. | 1.040 | 2.234 | .97 | .152 | 1.012 |
| Bole bark | D.b.h. | -0.566 | 1.985 | .95 | .186 | 1.017 |
| Total bole | D.b.h. | 1.211 | 2.206 | .97 | .150 | 1.011 |
| Leaves | D.b.h. | -1.062 | 1.540 | .54 | .569 | 1.173 |
| Branches | D.b.h. | -1.469 | 2.831 | .85 | .479 | 1.120 |
| Total canopy | D.b.h. | -1.077 | 2.701 | .84 | .471 | 1.116 |
| Total tree | $D^2H(in^2ft)$ | -1.545 | .923 | .97 | .169 | 1.014 |
| Bole wood | $D^2H$ | -1.715 | .894 | .98 | .135 | 1.009 |
| Bole bark | $D^2H$ | -3.038 | .797 | .96 | .161 | 1.129 |
| Total bole | $D^2H$ | -1.513 | .883 | .98 | .131 | 1.008 |
| Leaves | $D^2H$ | -2.434 | .550 | .43 | .631 | 1.217 |
| Branches | $D^2H$ | -4.524 | 1.078 | .77 | .585 | 1.184 |
| Total canopy | $D^2H$ | -3.976 | 1.027 | .76 | .574 | 1.176 |
| | | **Green Weight-kilograms** | | | | |
| Total tree | D.b.h.(cm) | -1.249 | 2.320 | .99 | .112 | 1.006 |
| Total bole | D.b.h. | -1.123 | 2.177 | .93 | .239 | 1.029 |
| Branches | D.b.h. | -4.712 | 2.885 | .86 | .464 | 1.112 |
| Leaves | D.b.h. | -2.617 | 1.592 | .58 | .537 | 1.153 |
| Total canopy | D.b.h. | -3.942 | 2.688 | .85 | .459 | 1.109 |
| Total tree | $D^2H(cm^2m)$ | -2.539 | .924 | .98 | .127 | 1.008 |
| Total bole | $D^2H$ | -2.427 | .878 | .95 | .204 | 1.021 |
| Branches | $D^2H$ | -6.005 | 1.113 | .80 | .550 | 1.161 |
| Leaves | $D^2H$ | -3.026 | .579 | .48 | .597 | 1.192 |
| Total canopy | $D^2H$ | -5.096 | 1.031 | .78 | .546 | 1.158 |

(Table 2 continued on next page)

(Table 2 continued)

| Dependent variable | Independent variable | Intercept (a) | Slope (b) | $r^2$ | $S_{y \cdot x}$[1] | Correction factor[2] |
|---|---|---|---|---|---|---|
| | | **Green Weight-pounds** | | | | |
| Total tree | D.b.h.(inches) | 1.705 | 2.320 | .99 | .112 | 1.006 |
| Total bole | D.b.h. | 1.697 | 2.177 | .93 | .239 | 1.029 |
| Branches | D.b.h. | -1.232 | 2.885 | .86 | .464 | 1.112 |
| Leaves | D.b.h. | -0.343 | 1.592 | .58 | .537 | 1.153 |
| Total canopy | D.b.h. | -0.645 | 2.688 | .85 | .459 | 1.109 |
| Total tree | $D^2H(in^2ft)$ | -1.086 | .920 | .97 | .154 | 1.018 |
| Total bole | $D^2H$ | -1.014 | .875 | .94 | .216 | 1.023 |
| Branches | $D^2H$ | -4.385 | 1.104 | .79 | .567 | 1.172 |
| Leaves | $D^2H$ | -1.792 | .573 | .47 | .603 | 1.196 |
| Total canopy | $D^2H$ | -3.537 | 1.023 | .77 | .561 | 1.168 |

[1]Standard error estimate in $\log_e$ form.

[2]Correction for bias inherent in applying logarithmic transformations; $\hat{Y}_{adj} = (\exp(a + b \cdot \ln x)) \cdot K$ (Beauchamp and Olson 1973).

Table 3.—*Total tree green weight of red maple trees (stand age ~ 40 years)*

(In kilograms)

| D.b.h. (cm) | Total tree height (meters) | | | | | |
|---|---|---|---|---|---|---|
| | 12 | 14 | 16 | 18 | 20 | 22 |
| **SI ≤ 45 EQUATION: $Log_e$ (total tree wt) = -2.888 + 0.975 $Log_e$ ($D^2H$)** | | | | | | |
| 10 | 56 | 65 | 74 | 83 | 92 | 101 |
| 12 | 80 | 93 | 106 | 119 | 131 | 144 |
| 14 | 108 | 125 | 143 | 160 | 178 | 195 |
| 16 | 140 | 163 | 185 | 208 | 230 | 253 |
| 18 | 176 | 205 | 233 | 261 | 290 | 318 |
| 20 | 216 | 251 | 286 | 321 | 356 | 391 |
| 22 | 260 | 303 | 345 | 387 | 429 | 470 |
| 24 | 309 | 359 | 408 | 458 | 508 | 557 |
| 26 | 361 | 419 | 477 | 536 | 594 | 651 |
| 28 | 417 | 484 | 552 | 619 | 686 | 753 |
| 30 | 477 | 554 | 631 | 708 | 785 | 861 |
| **SI 50-55 EQUATION: $Log_e$ (total tree wt) = -2.933 + 0.975 $Log_e$ ($D^2H$)** | | | | | | |
| 10 | 54 | 62 | 71 | 79 | 88 | 97 |
| 12 | 76 | 89 | 101 | 113 | 126 | 138 |
| 14 | 103 | 103 | 137 | 153 | 170 | 186 |
| 16 | 134 | 155 | 177 | 199 | 220 | 242 |
| 18 | 168 | 196 | 223 | 250 | 277 | 304 |
| 20 | 207 | 240 | 274 | 307 | 340 | 373 |
| 22 | 249 | 289 | 330 | 370 | 410 | 450 |
| 24 | 295 | 343 | 391 | 438 | 485 | 533 |
| 26 | 345 | 401 | 456 | 512 | 567 | 623 |
| 28 | 398 | 463 | 527 | 592 | 656 | 720 |
| 30 | 456 | 530 | 603 | 677 | 750 | 823 |
| **SI ≥ 60 EQUATION: $Log_e$ (total tree wt) = -2.978 + 0.975 $Log_e$ ($D^2H$)** | | | | | | |
| 10 | 51 | 59 | 68 | 76 | 84 | 92 |
| 12 | 73 | 85 | 97 | 108 | 120 | 132 |
| 14 | 99 | 115 | 131 | 146 | 162 | 178 |
| 16 | 128 | 149 | 169 | 190 | 210 | 231 |
| 18 | 161 | 187 | 213 | 239 | 265 | 291 |
| 20 | 198 | 230 | 262 | 293 | 325 | 357 |
| 22 | 238 | 277 | 315 | 353 | 392 | 430 |
| 24 | 282 | 328 | 373 | 419 | 464 | 509 |
| 26 | 330 | 383 | 436 | 490 | 542 | 595 |
| 28 | 381 | 443 | 504 | 566 | 627 | 688 |
| 30 | 436 | 506 | 577 | 647 | 717 | 787 |

Table 4.—*Total tree green weight of red maple trees (stand age ~ 70)*

(In kilograms)

| D.b.h. (cm) | Total tree height (meters) | | | | | |
|---|---|---|---|---|---|---|
| | 16 | 18 | 20 | 22 | 24 | 26 |
| **SI ≤ 45 EQUATION: $Log_e$ (total tree wt) = -3.211 + 1.002 $Log_e$ ($D^2H$)** | | | | | | |
| 14 | 128 | 145 | 161 | 177 | 193 | 209 |
| 16 | 168 | 189 | 210 | 231 | 252 | 273 |
| 18 | 213 | 239 | 266 | 293 | 319 | 346 |
| 20 | 263 | 295 | 328 | 361 | 394 | 427 |
| 22 | 318 | 358 | 397 | 437 | 477 | 517 |
| 24 | 378 | 426 | 473 | 521 | 568 | 615 |
| 26 | 444 | 500 | 556 | 611 | 667 | 723 |
| 28 | 515 | 580 | 644 | 709 | 774 | 838 |
| 30 | 592 | 666 | 740 | 814 | 888 | 963 |
| 32 | 673 | 758 | 842 | 927 | 1011 | 1095 |
| 34 | 760 | 856 | 951 | 1046 | 1142 | 1237 |
| **SI 50-55 EQUATION: $Log_e$ (total tree wt) = -3.286 + 1.002 $Log_e$ ($D^2H$)** | | | | | | |
| 14 | 119 | 134 | 149 | 164 | 179 | 194 |
| 16 | 156 | 175 | 195 | 214 | 234 | 253 |
| 18 | 197 | 222 | 247 | 271 | 296 | 321 |
| 20 | 244 | 274 | 305 | 335 | 366 | 396 |
| 22 | 295 | 332 | 369 | 406 | 443 | 480 |
| 24 | 351 | 395 | 439 | 483 | 527 | 571 |
| 26 | 412 | 464 | 515 | 567 | 619 | 670 |
| 28 | 478 | 538 | 598 | 658 | 718 | 778 |
| 30 | 549 | 618 | 687 | 755 | 824 | 893 |
| 32 | 625 | 703 | 781 | 860 | 938 | 1016 |
| 34 | 706 | 794 | 882 | 971 | 1059 | 1148 |
| **SI ≥ 60 EQUATION: $Log_e$ (total tree wt) = -3.361 + 1.002 $Log_e$ ($D^2H$)** | | | | | | |
| 14 | 111 | 124 | 138 | 152 | 166 | 180 |
| 16 | 145 | 163 | 181 | 199 | 217 | 235 |
| 18 | 183 | 206 | 229 | 252 | 275 | 298 |
| 20 | 226 | 254 | 283 | 311 | 339 | 368 |
| 22 | 274 | 308 | 342 | 376 | 411 | 445 |
| 24 | 326 | 366 | 407 | 448 | 489 | 530 |
| 26 | 382 | 430 | 478 | 526 | 574 | 622 |
| 28 | 444 | 499 | 555 | 610 | 666 | 722 |
| 30 | 509 | 573 | 637 | 701 | 765 | 828 |
| 32 | 580 | 652 | 725 | 798 | 870 | 943 |
| 34 | 655 | 737 | 819 | 901 | 983 | 1065 |

Table 5.—*Total tree dry weight of red maple trees (stand age ~ 40 years)*

(In kilograms)

| D.b.h. (cm) | Total tree height (meters) | | | | | |
|---|---|---|---|---|---|---|
| | 12 | 14 | 16 | 18 | 20 | 22 |
| **SI ≤ 45 EQUATION: $Log_e$(total tree wt) = -3.498 + 1.002 $Log_e$(D.b.h.²)(Ht)** | | | | | | |
| 10 | 37 | 43 | 49 | 55 | 61 | 68 |
| 12 | 53 | 62 | 71 | 80 | 89 | 97 |
| 14 | 72 | 84 | 96 | 109 | 121 | 133 |
| 16 | 94 | 110 | 126 | 142 | 158 | 173 |
| 18 | 120 | 140 | 160 | 180 | 200 | 220 |
| 20 | 148 | 172 | 197 | 222 | 246 | 271 |
| 22 | 179 | 209 | 239 | 268 | 298 | 328 |
| 24 | 213 | 248 | 284 | 320 | 355 | 391 |
| 26 | 250 | 292 | 333 | 375 | 417 | 459 |
| 28 | 290 | 338 | 387 | 435 | 484 | 532 |
| 30 | 333 | 389 | 444 | 500 | 555 | 611 |
| **SI 50-55 EQUATION: $Log_e$(total tree wt) = -3.581 + 1.002 $Log_e$(D.b.h.²)(Ht)** | | | | | | |
| 10 | 34 | 40 | 45 | 51 | 57 | 62 |
| 12 | 49 | 57 | 65 | 73 | 81 | 90 |
| 14 | 67 | 78 | 89 | 100 | 111 | 122 |
| 16 | 87 | 101 | 116 | 131 | 145 | 160 |
| 18 | 110 | 128 | 147 | 165 | 184 | 202 |
| 20 | 136 | 159 | 181 | 204 | 227 | 250 |
| 22 | 165 | 192 | 220 | 247 | 275 | 302 |
| 24 | 196 | 229 | 261 | 294 | 327 | 360 |
| 26 | 230 | 268 | 307 | 345 | 384 | 422 |
| 28 | 267 | 311 | 356 | 401 | 445 | 490 |
| 30 | 306 | 358 | 409 | 460 | 511 | 562 |
| **SI ≥ 60 EQUATION: $Log_e$(total tree wt) = -3.663 + 1.002 $Log_e$ (D.b.h.²)(Ht)** | | | | | | |
| 10 | 31 | 36 | 42 | 47 | 52 | 57 |
| 12 | 45 | 53 | 60 | 68 | 75 | 83 |
| 14 | 61 | 72 | 82 | 92 | 102 | 112 |
| 16 | 80 | 93 | 107 | 120 | 134 | 147 |
| 18 | 101 | 118 | 135 | 152 | 169 | 186 |
| 20 | 125 | 146 | 167 | 188 | 209 | 230 |
| 22 | 152 | 177 | 202 | 228 | 253 | 278 |
| 24 | 180 | 211 | 241 | 271 | 301 | 331 |
| 26 | 212 | 247 | 283 | 318 | 354 | 389 |
| 28 | 246 | 287 | 328 | 369 | 410 | 451 |
| 30 | 282 | 329 | 377 | 424 | 471 | 518 |

Table 6.—*Total tree dry weight of red maple trees (stand age ~ 70 years)*

(In kilograms)

| D.b.h. (cm) | Total tree height (meters) | | | | | |
|---|---|---|---|---|---|---|
| | 16 | 18 | 20 | 22 | 24 | 26 |
| **SI ≤ 45 EQUATION: $Log_e$(total tree wt) = -3.698 + 1.008 $Log_e$(D²H)** | | | | | | |
| 14 | 83 | 93 | 104 | 114 | 125 | 135 |
| 16 | 108 | 122 | 136 | 150 | 163 | 177 |
| 18 | 138 | 155 | 172 | 190 | 207 | 224 |
| 20 | 170 | 192 | 213 | 234 | 256 | 277 |
| 22 | 206 | 232 | 258 | 284 | 310 | 336 |
| 24 | 246 | 277 | 308 | 339 | 370 | 401 |
| 26 | 289 | 325 | 361 | 398 | 434 | 471 |
| 28 | 335 | 377 | 420 | 462 | 504 | 547 |
| 30 | 385 | 434 | 482 | 531 | 580 | 628 |
| 32 | 439 | 494 | 549 | 605 | 660 | 716 |
| 34 | 496 | 558 | 621 | 683 | 746 | 809 |
| **SI 50-55 EQUATION: $Log_e$(total tree wt) = -3.788 + 1.008 $Log_e$(D²H)** | | | | | | |
| 14 | 76 | 85 | 95 | 104 | 114 | 124 |
| 16 | 99 | 112 | 124 | 137 | 149 | 162 |
| 18 | 126 | 142 | 157 | 173 | 189 | 205 |
| 20 | 155 | 175 | 195 | 214 | 234 | 254 |
| 22 | 188 | 212 | 236 | 260 | 283 | 307 |
| 24 | 224 | 253 | 281 | 309 | 338 | 366 |
| 26 | 264 | 297 | 330 | 364 | 397 | 430 |
| 28 | 306 | 345 | 384 | 422 | 461 | 500 |
| 30 | 352 | 396 | 441 | 485 | 530 | 574 |
| 32 | 401 | 451 | 502 | 553 | 603 | 654 |
| 34 | 453 | 510 | 567 | 624 | 682 | 739 |
| **SI ≥ 60 EQUATION: $Log_e$(total tree wt) = -3.878 + 1.008 $Log_e$ (D²H)** | | | | | | |
| 14 | 69 | 78 | 87 | 95 | 104 | 113 |
| 16 | 91 | 102 | 113 | 125 | 136 | 148 |
| 18 | 115 | 129 | 144 | 158 | 173 | 187 |
| 20 | 142 | 160 | 178 | 196 | 214 | 232 |
| 22 | 172 | 194 | 216 | 237 | 259 | 281 |
| 24 | 205 | 231 | 257 | 283 | 309 | 335 |
| 26 | 241 | 271 | 302 | 332 | 363 | 393 |
| 28 | 280 | 315 | 351 | 386 | 421 | 457 |
| 30 | 322 | 362 | 403 | 443 | 484 | 525 |
| 32 | 366 | 413 | 459 | 505 | 551 | 598 |
| 34 | 414 | 466 | 518 | 571 | 623 | 675 |

Table 7.—*Total tree green weight of red maple trees (stand age ~ 40 years)*

(In pounds)

| D.b.h. (in) | Total tree height (feet) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 |
| **SI ≤ 45 EQUATION: $Log_e$ (total tree wt) = −1.709 + 1.025 $Log_e$ ($D^2H$)** | | | | | | | | |
| 2 | 24 | 29 | 33 | 37 | 41 | 46 | 50 | 54 |
| 4 | 101 | 119 | 136 | 154 | 171 | 189 | 206 | 224 |
| 6 | 233 | 273 | 313 | 353 | 393 | 433 | 474 | 514 |
| 8 | 420 | 492 | 564 | 636 | 709 | 782 | 855 | 928 |
| 10 | 663 | 777 | 891 | 1,005 | 1,120 | 1,235 | 1,350 | 1,466 |
| 12 | 964 | 1,129 | 1,295 | 1,461 | 1,628 | 1,795 | 1,962 | 2,130 |
| 14 | 1,323 | 1,549 | 1,776 | 2,004 | 2,233 | 2,462 | 2,691 | 2,921 |
| 16 | 1,739 | 2,037 | 2,335 | 2,635 | 2,935 | 3,237 | 3,539 | 3,841 |
| **SI 50-55 EQUATION: $Log_e$ (total tree wt) = −1.882 + 1.025 $Log_e$ ($D^2H$)** | | | | | | | | |
| 2 | 21 | 24 | 28 | 31 | 35 | 38 | 42 | 45 |
| 4 | 85 | 100 | 115 | 129 | 144 | 159 | 174 | 188 |
| 6 | 196 | 229 | 263 | 297 | 331 | 365 | 399 | 433 |
| 8 | 353 | 414 | 474 | 535 | 596 | 657 | 719 | 780 |
| 10 | 558 | 654 | 749 | 846 | 942 | 1,039 | 1,136 | 1,233 |
| 12 | 811 | 950 | 1,089 | 1,229 | 1,369 | 1,510 | 1,650 | 1,791 |
| 14 | 1,112 | 1,303 | 1,494 | 1,686 | 1,878 | 2,071 | 2,264 | 2,457 |
| 16 | 1,463 | 1,713 | 1,964 | 2,216 | 2,469 | 2,723 | 2,977 | 3,231 |
| **SI ≥ 60 EQUATION: $Log_e$ (total tree wt) = −2.054 + 1.025 $Log_e$ ($D^2H$)** | | | | | | | | |
| 2 | 17 | 20 | 23 | 26 | 29 | 32 | 35 | 38 |
| 4 | 72 | 84 | 96 | 109 | 121 | 134 | 146 | 159 |
| 6 | 165 | 193 | 221 | 250 | 278 | 307 | 336 | 364 |
| 8 | 297 | 348 | 399 | 451 | 502 | 554 | 605 | 657 |
| 10 | 470 | 550 | 631 | 712 | 793 | 875 | 956 | 1,038 |
| 12 | 683 | 800 | 917 | 1,035 | 1,153 | 1,271 | 1,390 | 1,508 |
| 14 | 937 | 1,097 | 1,258 | 1,419 | 1,581 | 1,743 | 1,906 | 2,069 |
| 16 | 1,232 | 1,442 | 1,654 | 1,866 | 2,079 | 2,292 | 2,506 | 2,720 |

Table 8.—*Total tree green weight of red maple trees (stand age ~ 70 years)*

(In pounds)

| D.b.h. (in) | Total tree height (feet) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| **SI ≤ 45 EQUATION: $Log_e$ (total tree wt) = −1.519 + 0.978 $Log_e$ ($D^2H$)** | | | | | | | | |
| 4 | 136 | 151 | 166 | 181 | 195 | 210 | 225 | 239 |
| 6 | 301 | 335 | 367 | 399 | 432 | 464 | 497 | 529 |
| 8 | 529 | 587 | 644 | 701 | 758 | 815 | 872 | 929 |
| 10 | 819 | 908 | 996 | 1,085 | 1,173 | 1,261 | 1,349 | 1,437 |
| 12 | 1,170 | 1,297 | 1,423 | 1,550 | 1,676 | 1,802 | 1,928 | 2,053 |
| 14 | 1,581 | 1,753 | 1,924 | 2,095 | 2,265 | 2,436 | 2,606 | 2,776 |
| 16 | 2,053 | 2,276 | 2,498 | 2,720 | 2,942 | 3,163 | 3,384 | 3,604 |
| 18 | 2,585 | 2,866 | 3,146 | 3,425 | 3,704 | 3,982 | 4,260 | 4,538 |
| **SI 50-55 EQUATION: $Log_e$ (total tree wt) = −1.609 + 0.978 $Log_e$ ($D^2H$)** | | | | | | | | |
| 4 | 125 | 138 | 152 | 165 | 179 | 192 | 205 | 219 |
| 6 | 276 | 305 | 335 | 365 | 395 | 424 | 454 | 484 |
| 8 | 484 | 536 | 588 | 641 | 693 | 745 | 797 | 849 |
| 10 | 748 | 829 | 911 | 991 | 1,072 | 1,153 | 1,233 | 1,314 |
| 12 | 1,069 | 1,185 | 1,301 | 1,416 | 1,532 | 1,647 | 1,762 | 1,876 |
| 14 | 1,445 | 1,602 | 1,758 | 1,915 | 2,071 | 2,226 | 2,382 | 2,537 |
| 16 | 1,876 | 2,080 | 2,283 | 2,486 | 2,688 | 2,891 | 3,092 | 3,294 |
| 18 | 2,363 | 2,619 | 2,875 | 3,130 | 3,385 | 3,639 | 3,894 | 4,147 |
| **SI ≥ 60 EQUATION: $Log_e$ (total tree wt) = −1.699 + 0.978 $Log_e$ ($D^2H$)** | | | | | | | | |
| 4 | 114 | 126 | 139 | 151 | 163 | 175 | 188 | 200 |
| 6 | 252 | 279 | 306 | 334 | 361 | 388 | 415 | 442 |
| 8 | 442 | 490 | 538 | 586 | 633 | 681 | 728 | 776 |
| 10 | 684 | 758 | 832 | 906 | 980 | 1,054 | 1,127 | 1,200 |
| 12 | 977 | 1,083 | 1,189 | 1,294 | 1,400 | 1,505 | 1,610 | 1,715 |
| 14 | 1,321 | 1,464 | 1,607 | 1,750 | 1,892 | 2,035 | 2,177 | 2,318 |
| 16 | 1,715 | 1,901 | 2,087 | 2,272 | 2,457 | 2,642 | 2,826 | 3,010 |
| 18 | 2,159 | 2,394 | 2,627 | 2,861 | 3,094 | 3,326 | 3,558 | 3,790 |

Table 9.—*Total tree dry weight of red maple trees (stand age ~ 40 years)*

(In pounds)

| D.b.h. | Total tree height (feet) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (in) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 |
| **SI ≤ 45 EQUATION: $Log_e$ (total tree wt) = −1.959 + 0.996 ln ($D^2H$)** | | | | | | | | |
| 2 | 17 | 19 | 22 | 25 | 28 | 30 | 33 | 36 |
| 4 | 66 | 77 | 88 | 99 | 110 | 121 | 132 | 143 |
| 6 | 148 | 173 | 197 | 222 | 246 | 271 | 295 | 320 |
| 8 | 263 | 306 | 350 | 393 | 437 | 480 | 524 | 567 |
| 10 | 410 | 478 | 546 | 614 | 681 | 749 | 817 | 885 |
| 12 | 589 | 687 | 785 | 882 | 980 | 1,077 | 1,175 | 1,275 |
| 14 | 801 | 934 | 1,066 | 1,199 | 1,332 | 1,465 | 1,597 | 1,730 |
| 16 | 1,045 | 1,218 | 1,391 | 1,565 | 1,738 | 1,911 | 2,084 | 2,257 |
| **SI 50-55 EQUATION: $Log_e$ (total tree wt) = −2.034 + 0.996 ln ($D^2H$)** | | | | | | | | |
| 2 | 15 | 18 | 21 | 23 | 26 | 28 | 31 | 33 |
| 4 | 61 | 71 | 82 | 92 | 102 | 112 | 122 | 132 |
| 6 | 137 | 160 | 183 | 206 | 229 | 251 | 274 | 297 |
| 8 | 244 | 284 | 325 | 365 | 405 | 446 | 486 | 526 |
| 10 | 380 | 443 | 506 | 569 | 632 | 695 | 758 | 821 |
| 12 | 546 | 637 | 728 | 818 | 909 | 999 | 1,090 | 1,180 |
| 14 | 743 | 866 | 989 | 1,113 | 1,236 | 1,359 | 1,482 | 1,605 |
| 16 | 969 | 1,130 | 1,291 | 1,452 | 1,612 | 1,773 | 1,933 | 2,094 |
| **SI ≥ 60 EQUATION: $Log_e$ (total tree wt) = −2.109 + 0.996 ln ($D^2H$)** | | | | | | | | |
| 2 | 14 | 17 | 19 | 21 | 24 | 26 | 28 | 31 |
| 4 | 57 | 66 | 76 | 85 | 95 | 104 | 113 | 123 |
| 6 | 127 | 149 | 170 | 191 | 212 | 233 | 254 | 275 |
| 8 | 226 | 264 | 301 | 339 | 376 | 413 | 451 | 488 |
| 10 | 353 | 411 | 470 | 528 | 586 | 645 | 703 | 762 |
| 12 | 507 | 591 | 675 | 759 | 843 | 927 | 1,011 | 1,095 |
| 14 | 689 | 804 | 918 | 1,032 | 1,146 | 1,261 | 1,375 | 1,489 |
| 16 | 899 | 1,049 | 1,198 | 1,347 | 1,496 | 1,645 | 1,794 | 1,942 |

Table 10.—*Total tree dry weight of red maple trees (stand age ~ 70 years)*

(In pounds)

| D.b.h. | Total tree height (feet) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (in) | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| **SI ≤ 45 EQUATION: $Log_e$ (total tree wt) = −1.990 + 0.981 ln ($D^2H$)** | | | | | | | | |
| 4 | 87 | 96 | 106 | 115 | 125 | 134 | 143 | 153 |
| 6 | 192 | 213 | 234 | 255 | 276 | 297 | 318 | 338 |
| 8 | 338 | 375 | 412 | 449 | 485 | 522 | 559 | 595 |
| 10 | 524 | 581 | 638 | 695 | 752 | 809 | 865 | 922 |
| 12 | 750 | 831 | 913 | 994 | 1,075 | 1,157 | 1,237 | 1,318 |
| 14 | 1,015 | 1,125 | 1,235 | 1,345 | 1,455 | 1,565 | 1,675 | 1,784 |
| 16 | 1,318 | 1,462 | 1,605 | 1,748 | 1,891 | 2,034 | 2,176 | 2,318 |
| 18 | 1,661 | 1,842 | 2,023 | 2,203 | 2,383 | 2,562 | 2,742 | 2,921 |
| **SI 50-55 EQUATION: $Log_e$ (total tree wt) = −2.095 + 0.981 ln ($D^2H$)** | | | | | | | | |
| 4 | 78 | 87 | 95 | 104 | 112 | 121 | 129 | 138 |
| 6 | 173 | 192 | 211 | 230 | 249 | 267 | 286 | 305 |
| 8 | 305 | 338 | 371 | 404 | 437 | 470 | 503 | 536 |
| 10 | 472 | 523 | 575 | 626 | 677 | 728 | 779 | 830 |
| 12 | 675 | 749 | 822 | 895 | 968 | 1,041 | 1,114 | 1,187 |
| 14 | 913 | 1,013 | 1,112 | 1,211 | 1,310 | 1,409 | 1,508 | 1,606 |
| 16 | 1,187 | 1,316 | 1,445 | 1,574 | 1,703 | 1,831 | 1,959 | 2,087 |
| 18 | 1,496 | 1,658 | 1,821 | 1,983 | 2,145 | 2,307 | 2,468 | 2,630 |
| **SI ≥ 60 EQUATION: $Log_e$ (total tree wt) = −2.200 + 0.981 ln ($D^2H$)** | | | | | | | | |
| 4 | 70 | 78 | 86 | 93 | 101 | 109 | 116 | 124 |
| 6 | 156 | 173 | 190 | 207 | 224 | 241 | 257 | 274 |
| 8 | 274 | 304 | 334 | 364 | 393 | 423 | 453 | 482 |
| 10 | 425 | 471 | 517 | 564 | 610 | 656 | 701 | 747 |
| 12 | 608 | 674 | 740 | 806 | 872 | 937 | 1,003 | 1,069 |
| 14 | 822 | 912 | 1,001 | 1,090 | 1,180 | 1,269 | 1,357 | 1,446 |
| 16 | 1,069 | 1,185 | 1,301 | 1,417 | 1,533 | 1,648 | 1,764 | 1,879 |
| 18 | 1,346 | 1,493 | 1,639 | 1,786 | 1,931 | 2,077 | 2,222 | 2,368 |

Table 11.—*Total tree weight—d.b.h. (N = 150)*

**Green weight[1]**

**Equations: $Log_e$ (total tree wt-kg) = -1.249 + 2.320 $log_e$ (D.b.h.-cm)**
**$Log_e$ (total tree wt-lbs) = 1.705 + 2.320 $log_e$ (D.b.h.-in.)**

| D.b.h. | Weight | D.b.h. | Weight |
|---|---|---|---|
| *cm* | *kg* | *in.* | *lbs* |
| 10 | 60 | 4 | 138 |
| 12 | 92 | 5 | 231 |
| 14 | 132 | 6 | 353 |
| 16 | 179 | 7 | 505 |
| 18 | 236 | 8 | 689 |
| 20 | 301 | 9 | 905 |
| 22 | 375 | 10 | 1,156 |
| 24 | 459 | 11 | 1,442 |
| 26 | 553 | 12 | 1,765 |
| 28 | 657 | 13 | 2,125 |
| 30 | 771 | 14 | 2,524 |
| 32 | 896 | 15 | 2,962 |
| 34 | 1,031 | 16 | 3,440 |
| 36 | 1,177 | 17 | 3,960 |
| 38 | 1,334 | 18 | 4,522 |
| 40 | 1,503 | 19 | 5,126 |
| 42 | 1,683 | 20 | 5,774 |

**Dry weight[1]**

**Equations: $Log_e$ (total tree wt-kg) = -1.721 + 2.334 $Log_e$ (D.b.h.-cm)**
**$Log_e$ (total tree wt-lbs) = 1.245 + 2.334 $Log_e$ (D.b.h.-in.)**

| D.b.h. | Weight | D.b.h. | Weight |
|---|---|---|---|
| *cm* | *kg* | *in.* | *lbs* |
| 10 | 39 | 4 | 89 |
| 12 | 59 | 5 | 150 |
| 14 | 85 | 6 | 229 |
| 16 | 116 | 7 | 328 |
| 18 | 153 | 8 | 448 |
| 20 | 196 | 9 | 590 |
| 22 | 245 | 10 | 754 |
| 24 | 300 | 11 | 943 |
| 26 | 361 | 12 | 1,155 |
| 28 | 430 | 13 | 1,392 |
| 30 | 505 | 14 | 1,655 |
| 32 | 587 | 15 | 1,944 |
| 34 | 676 | 16 | 2,260 |
| 36 | 773 | 17 | 2,604 |
| 38 | 877 | 18 | 2,975 |
| 40 | 988 | 19 | 3,375 |
| 42 | 1,107 | 20 | 3,805 |

[1]Correction factors have been applied to weight estimates; K = 1.007.

Table 12.—*Residual weight (green) assuming 4 inch top diameter inside bark; residue = canopy weight + bole weight above 4-inch top*

| Stand age/SI | Equations[1] |
|---|---|
| **Y = green weight (kg); X = d.b.h. (cm)[2]** | |
| 40 ≤ 45 | $\ln Y = -0.903 + 1.811 \ln D.b.h.$ |
| 40 50-55 | $\ln Y = 0.111 + 1.395 \ln D.b.h.$ |
| 40 ≥ 60 | $\ln Y = -1.264 + 1.909 \ln D.b.h.$ |
| 70 ≤ 45 | $\ln Y = -2.512 + 2.338 \ln D.b.h.$ |
| 70 50-55 | $\ln Y = -1.746 + 2.044 \ln D.b.h.$ |
| 70 ≥ 60 | $\ln Y = -4.385 + 2.801 \ln D.b.h.$ |
| **Y = green weight (kg); X = $D^2H$ ($cm^2m$)[2]** | |
| 40 ≤ 45 | $\ln Y = -2.533 + 0.811 \ln D^2H$ |
| 40 50-55 | $\ln Y = -0.895 + 0.595 \ln D^2H$ |
| 40 ≥ 60 | $\ln Y = -2.555 + 0.786 \ln D^2H$ |
| 70 ≤ 45 | $\ln Y = -4.179 + 0.975 \ln D^2H$ |
| 70 50-55 | $\ln Y = -3.492 + 0.876 \ln D^2H$ |
| 70 ≥ 60 | $\ln Y = -6.769 + 1.190 \ln D^2H$ |

[1]ln = natural logarithms, base e.
[2]For conversion to English units:
kg x 2.2046 = *pounds*
cm x 0.3937 = inches
m x 3.2808 = feet

Table 13.—*Regression equations for estimating stem volume of red maples; Y = cubic volume in $m^3$*

| Equation[1] | $r^2$ | $S_{yy \cdot x}$ | Correction factor (K)[2] |
|---|---|---|---|
| Y = volume ($m^3$) outside bark–total stem | | | |
| X = d.b.h. (cm) | | | |
| sample number (N) = 331 | | | |
| $Y = -0.012 + 0.00075(X^2)$ | 0.92 | 0.085 | |
| $\ln Y = -7.900 + 2.207(\ln x)$ | .95 | .207 | 1.022 |
| Y = volume ($m^3$) outside bark–total stem | | | |
| X = $D^2H$ ($cm^2m$) | | | |
| N = 331 | | | |
| $Y = 0.042 + 0.000031(X)$ | .89 | .097 | – |
| $\ln Y = -9.403 + 0.910(\ln X)$ | .95 | .194 | 1.019 |
| Y = volume ($m^3$) inside bark–total stem | | | |
| X = d.b.h. (cm) | | | |
| N = 331 | | | |
| $Y = -0.011 + 0.00067(X^2)$ | .91 | .075 | – |
| $\ln Y = -8.210 + 2.271(\ln X)$ | .93 | .248 | 1.031 |
| Y = volume ($m^3$) inside bark–total stem | | | |
| X = $D^2H$ ($cm^2m$) | | | |
| N = 331 | | | |
| $Y = 0.037 + 0.000028(X)$ | .90 | .084 | – |
| $\ln Y = -9.759 + 0.937(\ln X)$ | .94 | .236 | 1.028 |
| Y = volume ($m^3$) inside bark–above 1-ft stump to 8-inch top | | | |
| X = d.b.h. (cm) | | | |
| N = 84 | | | |
| $Y = -0.181 + 0.000577(X^2)$ | .86 | .096 | – |
| $\ln Y = -12.544 + 3.338(\ln X)$ | .83 | .277 | 1.038 |
| Y = volume ($m^3$) inside bark–above 1-ft stump to 8-inch top | | | |
| X = $D^2H$ ($cm^2m^2$) | | | |
| N = 84 | | | |
| $Y = -0.108 + 0.000023(X)$ | .86 | .096 | – |
| $\ln Y = -15.391 + 1.437(\ln X)$ | .82 | .289 | 1.042 |
| Y = volume ($m^3$) inside bark–above 1-ft stump to 4-inch top | | | |
| X = d.b.h. (cm) | | | |
| N = 262 | | | |
| $Y = -0.037 + 0.000057(X^2)$ | .92 | .064 | – |
| $\ln Y = -9.967 + 2.732(\ln X)$ | .89 | .319 | 1.052 |
| Y = volume ($m^3$) inside bark–above 1-ft stump to 4-inch top | | | |
| X = $D^2H$ ($cm^2m$) | | | |
| N = 262 | | | |
| $Y = 0.0052 + 0.000024(X)$ | .93 | .060 | – |
| $\ln Y = -11.970 + 1.142(\ln X)$ | .90 | .308 | 1.048 |

[1] $\ln = \text{Log}_e$

[2] $Y_{adj} = (\exp(a + b \cdot \ln X)) \cdot K$



U.S. GOVERNMENT PRINTING OFFICE:1984-765-557/5136